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[FAD 2: Sugar Industry]

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Indian Standard
LAYOUT PLAN FOR SUGAR FACTORY LABORATORIES

(First Reprint MAY 1988)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 7 *August* 1970

Indian Standard
LAYOUT PLAN FOR SUGAR FACTORY LABORATORIES

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Indian Standard
LAYOUT PLAN FOR SUGAR FACTORY LABORATORIES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 December 1969, after the draft finalized by the Sugar Industry Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 The need for a standard layout for a sugar factory laboratory for quality control of sugar, sugar-products and by-products has been keenly felt by those responsible for planning and organization of sugar factories. Such a readily available plan will be of great use to various sugar factories in guiding them to set up laboratories according to their type of production.

0.3 This standard covers the tests that are generally carried out in a sugar factory laboratory; guidelines regarding flooring, ventilation, cupboards and benches; and a list of apparatus, equipment and chemicals required for a sugar factory laboratory to help various organizations in starting work in the laboratories.

0.4 This standard follows the requirements of analytical procedures laid down in the publication ' System of technical control for cane sugar factories in India ' issued by the Sugar Technologists' Association of India. This standard is in the nature of recommendations giving all the essentials normally required for a sugar factory laboratory but modifications could be made to suit individual cases, if necessary.

0.5 The recommendations contained in this standard are mainly based upon the information on layout plan of sugar factory laboratories supplied by various sugar factories in the country.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the layout plans for laboratories of sugar factories primarily forr outine testing of sugar, its raw materials and by-products.

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*Rules for rounding off numerical values (*revised*).

2. TESTS

2.1 The laboratory shall be equipped for carrying out the tests as given in Table 1.

TABLE 1 TESTS TO BE GENERALLY CARRIED OUT IN A SUGAR FACTORY LABORATORY AT DIFFERENT STAGES OF MANUFACTURE OF SUGAR

PARTICULARS OF TEST (1)	REF TO CL NO. OF IS : 499-1958*/ OTHER STANDARDS (2)
Soil†	
1. Sand	—
2. Silica	—
3. Clay	—
4. Nitrogen	—
5. Phosphorus	—
6. Potash	—
7. Organic matter	—
8. *p*H	—
9. Moisture	—
Juice, Syrup, Molasses and Massecuite	
1. Brix	—
2. Pol	—
3. Sucrose	—
4. Reducing sugars	—
5. Phosphate	—
6. Ash	—
7. Calcium oxide	—
8. *p*H	—
9. Colour	—
10. Turbidity	—
Bagasse and Filter Cake	
1. Moisture	—
2. Pol	—
3. Fibre	—
Additives and Chemicals	
1. Calcium, active	—
2. Calcium carbonate ($CaCO_3$)	—

(*Continued*)

TABLE 1 TESTS TO BE GENERALLY CARRIED OUT IN A SUGAR FACTORY LABORATORY AT DIFFERENT STAGES OF MANUFACTURE OF SUGAR — *Contd*

PARTICULARS OF TEST	REF TO CL NO. OF IS : 499-1958*/ OTHER STANDARDS
(1)	(2)
Gas Analysis†	
1. Carbon monoxide (CO)	—
2. Carbon dioxide (CO_2)	—
3. Sulphur dioxide (SO_2)	—
4. Oxygen (O_2)	—
Condensate Water, Boiler Feed Water, Spray Pond Water, Boiler Blow Down Water and Effluent Water	
1. Sugar content	—
2. *p*H	—
3. Solids in suspension and dissolved	—
4. BOD value for effluent water	—
Plantation White Sugar	
1. Pol	5
2. Moisture	4
3. Sucrose	6
4. Ash, sulphated	8
5. Grade	IS : 498-1970‡
6. Sieve test for grain size	IS : 498-1970‡
Refined Sugar†	
1. Moisture	4
2. Sucrose	6
3. Reducing sugars	7
4. Specific conductivity	IS : 1151-1969§
5. Colour	IS : 1151-1969§
Icing Sugar†	
1. Moisture	4
2. Reducing sugars	6
3. Starch	IS : 1152-1958‖
4. Total of starch and sucrose	IS : 1152-1958‖
5. Particle size	IS : 1152-1958‖
6. Colour	IS : 1152-1958‖

(*Continued*)

TABLE 1 TESTS TO BE GENERALLY CARRIED OUT IN A SUGAR FACTORY LABORATORY AT DIFFERENT STAGES OF MANUFACTURE OF SUGAR — *Contd*

PARTICULARS OF TEST (1)	REF TO CL NO. OF IS : 499-1958*/ OTHER STANDARDS (2)
Cube Sugar†	
1. Moisture	4
2. Sucrose	6
3. Reducing sugars	7
4. Specific conductivity	IS : 1168-1959¶
5. Size of blocks	IS : 1168-1959¶
6. Damaged cubes	IS : 1168-1959¶
7. Hardness of blocks	IS : 1168-1959¶
8. Break down test	IS : 1168-1959¶
Sugar used in Food Preservation Industry†	
1. Colour	IS : 1151-1969§
2. Pol	5
3. Specific conductivity	IS : 1151-1969§
4. Moisture	4
5. Reducing sugars	6
6. Ash, sulphated	8
7. Sulphur dioxide	10
8. Arsenic	11
9. Lead	13
10. Total colony count	IS : 1679-1960**
11. Total thermophilic spores	IS : 1679-1960**
12. Flat sour spores	IS : 1679-1960**
13. Thermophilic anaerobes producing gas	IS : 1679-1960**
14. Sulphide spoilage spores	IS : 1679-1960**
15. Yeast	IS : 1679-1960**
16. Mould	IS : 1679-1960**

(*Continued*)

TABLE 1 TESTS TO BE GENERALLY CARRIED OUT IN A SUGAR FACTORY LABORATORY AT DIFFERENT STAGES OF MANUFACTURE OF SUGAR — *Contd*

PARTICULARS OF TEST (1)	REF TO CL NO. OF IS : 499-1958*/ OTHER STANDARDS (2)
Final Molasses	
1. Brix	IS : 1162-1958††
2. Ash, sulphated	IS : 1162-1958††
3. Total reducing matter as invert sugar	IS : 1162-1958††
4. Viscosity	—
5. Pol	—
6. Sucrose	—
Water Supply†	
1. Hardness	IS : 3025-1964‡‡
2. Chlorine content	IS : 3025-1964‡‡
3. Coliform test	IS : 1622-1964§§
4. Plate count	IS : 3025-1964‡‡
5. Carbon dioxide (CO_2)	IS : 3025-1964‡‡
6. *p*H	IS : 3025-1964‡‡

*Methods of test for vacuum pan sugar (plantation white).

†The test is optional.

‡Grading for vacuum pan sugar (plantation white) (*third revision*) (*under print*).

§Specification for refined sugar (*first revision*).

||Specification for icing sugar.

¶Specification for cube sugar.

**Specification for sugar used in food preservation industry.

††Specification for cane molasses.

‡‡Methods of sampling and test (physical and chemical) for water used in industry.

§§Methods of sampling and test for microbiological examination of water used in industry.

3. LOCATION

3.1 The laboratory should be so located in the sugar factory premises that it is easily accessible to all the major activities of the factory. It shall be so located as to avoid vibrations of all kinds and should preferably be in a separate building close to the processing units.

4. LAYOUT

4.1 The laboratory should have adequate number of rooms as indicated in Table 2. While setting up a laboratory, the possible expansion of the factory should be kept in view. Typical layout plans for a sugar factory laboratory have been given in Fig. 1A and 1B.

TABLE 2 RECOMMENDED FLOOR AREA FOR A SUGAR FACTORY LABORATORY

SL No.	PARTICULARS OF ROOM	AREA m^2
1.	Labcratory-in-charge's room	12
2.	Store	9
3.	Chief chemist's room/library	12
4.	Analytical hall	53
5.	Room for polarimeter	8·75
6.	Space for shredder and laboratory crusher	9
7.	Verandahs and toilet	26·50
8.	Balance instruments room	10
9.	Total floor area	140·25

5. GENERAL REQUIREMENTS

5.1 Walls — Walls of the laboratory shall be smoothly finished. They may be tiled with glazed tiles (*see* IS : 2110-1964*).

5.2 Windows — There should be a sufficient number of windows fitted with glass panes to receive adequate natural light (*see* IS : 2440-1963†). To facilitate easy access, the windows should be at a height over 100 cm from floor and the benches should be at the same or lesser height.

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*Code of practice for *in situ* construction of walls in buildings with soil-cement.

†Code of practice for daylighting of buildings.

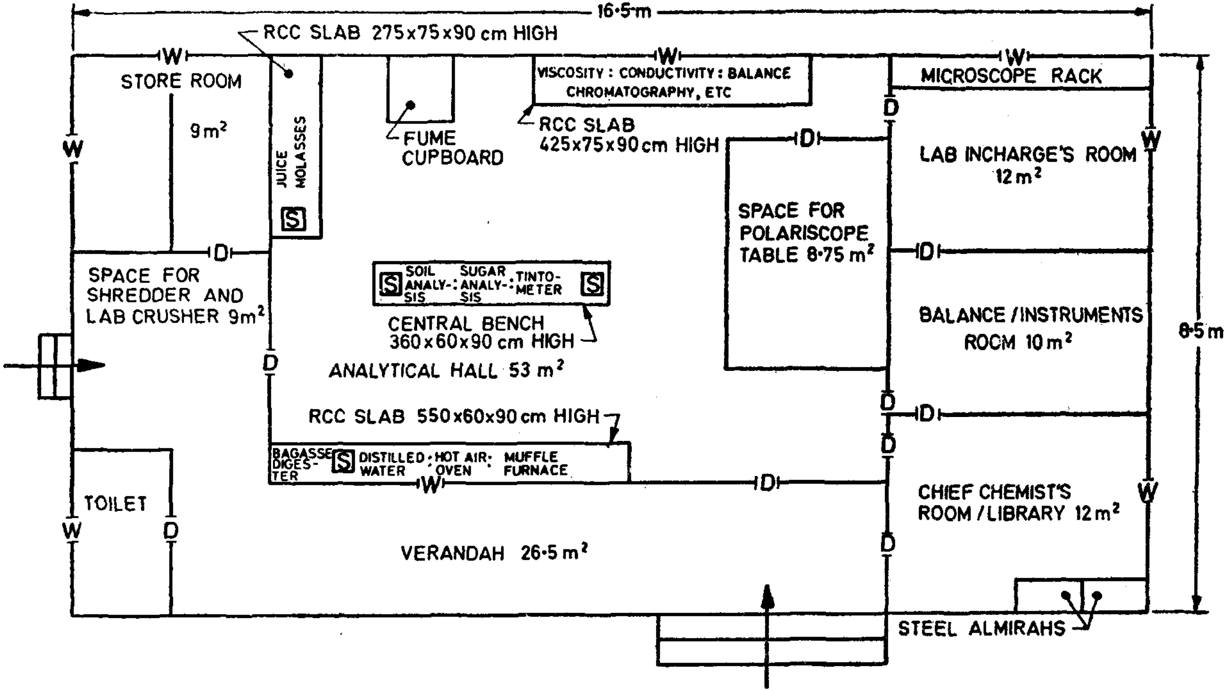
16·5 m
RCC SLAB 275x75x90 cm HIGH
W
STORE ROOM
9 m²
JUICE
MOLASSES
S
FUME CUPBOARD
VISCOSITY : CONDUCTIVITY : BALANCE
CHROMATOGRAPHY, ETC
RCC SLAB 425x75x90 cm HIGH
MICROSCOPE RACK
D
LAB INCHARGE'S ROOM 12 m²
SPACE FOR POLARISCOPE TABLE 8·75 m²
SOIL ANALYSIS
SUGAR ANALYSIS
TINTOMETER
CENTRAL BENCH 360x60x90 cm HIGH
SPACE FOR SHREDDER AND LAB CRUSHER 9m²
ANALYTICAL HALL 53 m²
BALANCE / INSTRUMENTS ROOM 10 m²
8·5 m
RCC SLAB 550x60x90 cm HIGH
BAGASSE DIGESTER
DISTILLED WATER
HOT AIR OVEN
MUFFLE FURNACE
TOILET
CHIEF CHEMIST'S ROOM / LIBRARY 12 m²
VERANDAH 26·5 m²
STEEL ALMIRAHS

FIG. 1A TYPICAL PLAN OF A SUGAR FACTORY LABORATORY

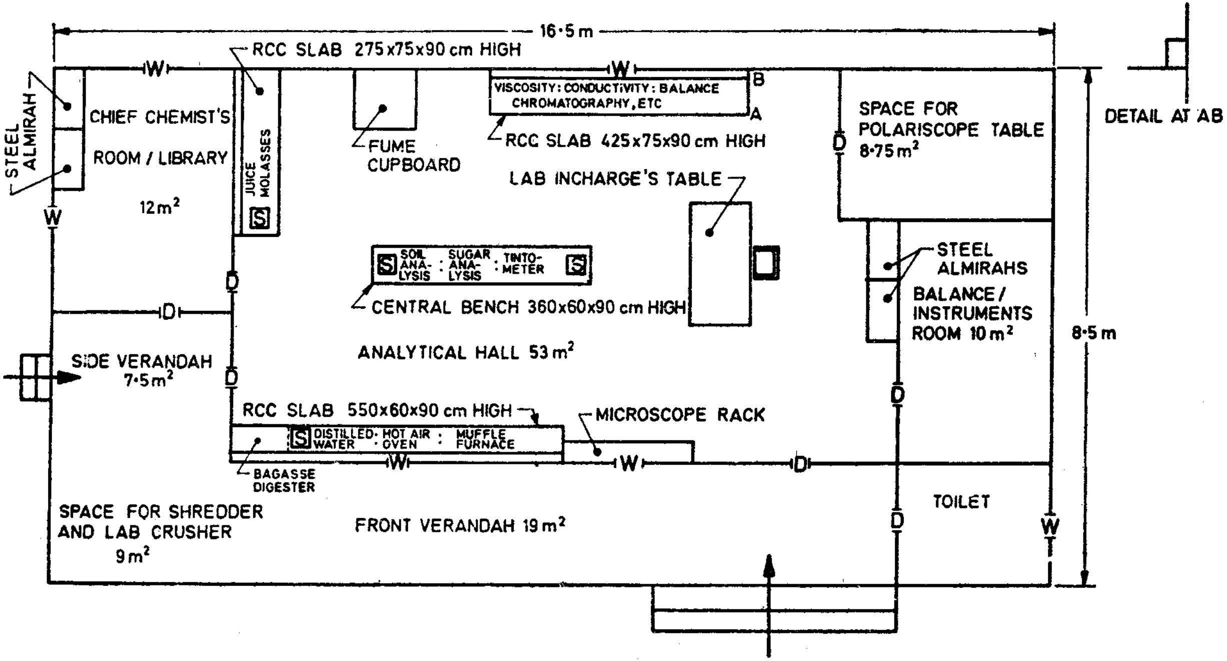
16·5 m
RCC SLAB 275x75x90 cm HIGH
W
W
B
A
STEEL ALMIRAH
CHIEF CHEMIST'S ROOM / LIBRARY
12 m²
JUICE MOLASSES
S
FUME CUPBOARD
VISCOSITY : CONDUCTIVITY : BALANCE CHROMATOGRAPHY, ETC
RCC SLAB 425x75x90 cm HIGH
D
SPACE FOR POLARISCOPE TABLE 8·75 m²
DETAIL AT AB
LAB INCHARGE'S TABLE
S
SOIL ANA-LYSIS : SUGAR ANA-LYSIS : TINTO-METER
S
STEEL ALMIRAHS
BALANCE / INSTRUMENTS ROOM 10 m²
D
D
CENTRAL BENCH 360x60x90 cm HIGH
8·5 m
ANALYTICAL HALL 53 m²
SIDE VERANDAH 7·5 m²
D
D
RCC SLAB 550x60x90 cm HIGH
MICROSCOPE RACK
S
DISTILLED WATER · HOT AIR OVEN · MUFFLE FURNACE
W
W
D
BAGASSE DIGESTER
TOILET
D
W
SPACE FOR SHREDDER AND LAB CRUSHER 9 m²
FRONT VERANDAH 19 m²

Fig. 1B Typical Plan of a Sugar Factory Laboratory (Alternative)

5.3 Lighting — Direct sunlight should be avoided for benches intended for sensitive instruments, for example, chemical balances. Lights should be provided to give a minimum average intensity of 300 to 450 lux at working level. For store room, corridor, etc, the intensity may be considerably lower. Special operations may require special lighting [*see* IS : 3646 (Part II)-1966*].

5.4 Flooring — The laboratory flooring should be non-slippery, capable of being easily cleaned and non-absorbent. Any type of *in situ* cement concrete or tiled floor is considered satisfactory (*see* IS : 4971-1968†).

5.5 Store Room — The store room should consist of two chambers, one for keeping acids, ammonia, other alkalies, etc, and the other for keeping fine chemicals, apparatus and equipment (*see* Fig. 1A). Alternatively, separate steel almirahs may be used for storing chemicals and apparatus. These almirahs may be kept in the analytical hall (*see* Fig. 1B).

5.6 Benches

5.6.1 The minimum height of benches from the floor shall be 90 cm.

5.6.2 The thickness of the bench top should be 3 cm. The bench top should be fitted with either glazed tiles or decorative thermosetting synthetic resin bonded laminated sheets.

5.6.3 The benches shall not have any underbench fittings as they tend to collect lot of dirt and insects in them.

5.6.4 The benches may be arranged as shown in Fig. 1A and 1B.

5.6.5 Typical details of above-bench fittings are shown in Fig. 2 for guidance only.

5.7 Cupboards

5.7.1 A laboratory should be provided with adequate number of cupboards to protect apparatus and also to permit tidiness and cleanliness in laboratory work.

5.7.2 *Wall Cupboards* — Wall cupboards may be provided and fixed at a convenient height of, say, 135 cm. With this height it is possible to have a wall bench below the cupboard which could be used for routine work. The convenient dimensions for wall cupboards are 150 × 90 × 30 cm, and 180 × 85 × 35 cm. The doors of the cupboard should preferably be of sliding type rather than hinged. These should be used for keeping certain reagent and chemical bottles. Use of steel almirahs in place of the wall cupboards may also be considered (**5.5**).

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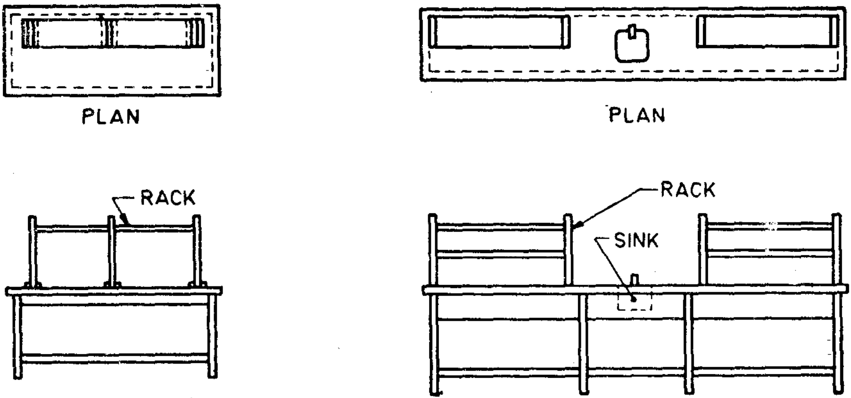
*Code of practice for interior illumination: Part II Schedule for values of illumination and glare index.

†Recommendations for selection of industrial floor finishes.



2A 2B

Fig. 2 Typical Plans and Elevations of Above-Bench Fittings

5.8 Sinks

5.8.1 Sinks of suitable dimensions should be provided in the laboratory. They should be made of glazed earthenware (*see* IS : 771-1963*) or vitreous ware [*see* IS : 2556 (Part V)-1967†] or stainless steel and should be preferably of dimensions of 60 × 45 × 20 cm or 45 × 30 × 15 cm. There shall be no overhanging shelf or cupboard over the sink.

5.8.2 It is advantageous to have a sink at a distance of about one metre on either side of the laboratory bench.

5.8.3 It is recommended that the sinks on the service bench should be fitted beneath the bench top, the hole being cut to reveal part of the rim and sealed with a non-hardening mastic or protected by a decorative thermosetting synthetic bonded laminated sheets flushing. The sinks on the surface bench may be made out of porcelain or other suitable material.

5.8.4 A washing sink and draining board may be provided in one corner of the laboratory to facilitate washing and drying of apparatus.

5.9 Fume Cupboard

5.9.1 The laboratory should be equipped with a fume cupboard of suitable dimensions. The fume cupboard should be equipped with services and provided with an efficient means of removing objectionable fumes, gases, vapours, etc.

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*Specification for glazed earthenware sanitary appliances (*revised*).

†Specification for vitreous sanitary appliances (vitreous china): Part V Specific requirements of laboratory sinks (*first revision*).

5.9.2 The fume cupboards may be built against the wall. The inside wall shall be faced with white glazed tiles or glazed with a white acid resistance paint. The fume cupboard floor may be made of hard asbestos or RCC slab faced with white glazed tiles. An adequate air flow through the fume cupboard shall be ensured.

5.9.3 *Services* — The main services required in a fume cupboard are gas, water, waste outlet and electricity. All services should be plainly identified by the use of colours, distinctively shaped taps, labelling, etc. All mechanical services should have outside controls with the outlets arranged in the front corners of the base, in the front pilasters or along the sides of the fume cupboard. Electricity outlets should be arranged outside the fume cupboard and it is desirable that they be kept as far away as possible from the water services.

5.10 Water Supply — In the normal course, when sugar factories have adequate water supply, there should be no special problems of providing water to the laboratory as such. Adequate water supply at sufficient head to work or filter pump efficiently should be provided. Generally 2 to 10 points are needed in a sugar factory laboratory depending upon the size.

5.11 Distilled Water — The laboratory shall be equipped with a distilled water plant of adequate capacity.

5.12 The laboratory shall be equipped with electrical heating system. Provision of 15 amperes power point units should be adequate. Wherever necessary, the laboratory may be provided with gas heating system.

5.13 Service Lines — The service lines, namely, those of tap water, electric power and gas should run along walls, 80 cm above floor level and connections taken to the laboratory benches. Following points should be borne in mind while installing service lines:

a) Benches should be easily removable, and

b) Service lines should be easily accessible.

5.13.1 The laboratory may be provided with connections for carbon dioxide, sulphur dioxide, vacuum, steam and compressed air. In addition, there should be a provision for 3-phased 5 kW electric connections. Provision for suitable voltage stabilization shall also be made.

5.14 Drainage — An underground system complying with the requirements given in IS : 1742-1960* should be provided. It should be covered with metal or cement slabs which are easily removable for easy cleaning and inspection. At the outlet of the laboratory drain a siphon trap shall be provided to prevent the entry of rodents. It is, however, desirable that the drainage should be through closed drain pipes.

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*Code of practice for building drainage.

5.15 Each laboratory shall be equipped with fire extinguishers of suitable sizes (*see* IS : 2190-1962*).

5.16 To ensure sufficient ventilation, an exhaust fan of suitable size should be provided in the laboratory (*see* IS : 2312-1967†).

5.17 The laboratory shall be equipped with a first-aid box.

6. SPECIAL REQUIREMENTS

6.1 Balance/Instruments Room — The balance room should be so located in the laboratory that it is least affected by vibrations and be away from all sources of air contamination.

6.2 Doors — The laboratory should be provided with minimum of two exits. The doors of the laboratory should be self-closing.

6.3 Drains — The drains should be made of stoneware. The volume of discharge should be considered while constructing the drains. The drains should be made of an acid-proof material and should be provided with suitable traps.

6.4 All the rooms meant for analytical work in the laboratory should be fly-proof and rodent-proof.

7. APPARATUS AND EQUIPMENT

7.1 The lists of apparatus and equipment required for routine and special analytical work in a sugar factory laboratory are given in Appendices A and B respectively.

8. CHEMICALS AND CONSUMABLE STORES

8.1 The lists of chemicals and consumable stores required for routine and special analytical work in a sugar factory laboratory are given in Appendices C and D respectively. Pure chemicals should be stored unless mentioned otherwise.

APPENDIX A

(*Clause* 7.1)

LIST OF APPARATUS AND EQUIPMENT REQUIRED FOR ROUTINE ANALYTICAL WORK IN A SUGAR FACTORY LABORATORY

Adaptors, glass, for condensers

Asbestos sheets

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*Code of practice for selection, installation and maintenance of portable first-aid fire appliances.

†Specification for propeller type ac ventilating fans (*first revision*).

Aspirator bottles, glass/polyethylene, with stopper and outlet near the bottom, capacity 3 to 5 litres

Augers, soil, 1-m extension tube

Bagasse digester

Bagasse drying trays

Balance, analytical, capacity 200 g on each pan, sensitivity 1/10 mg with case (preferably chainometric or single pan)

Balance, box scale, capacity 1 kg

Balance, physical, capacity 200 g on each pan, sensitivity 1 mg, with case

Basins, evaporating, glazed porcelain, with spout

Basins, evaporating, platinum

Basins, glass

Basins, nickel/german silver

Beakers, heat-resistant, glass, with spout: capacity 2 litres, 1 litre, 750 ml, 500 ml, 250 ml, 100 ml and 50 ml

Bell jars

Bottles, dropping

Bottles, reagent glass, narrow-mouth, stoppered: capacity 2 litres, 1 litre, 800 ml, 250 ml and 150 ml

Bottles, reagent glass, wide-mouth, stoppered: capacity 2 litres, 1 litre, 500 ml, 250 ml and 120 ml

Bottles, specific gravity, glass

Bottles, sugar sample, glass

Bottles, sugar weighing

Bottles, wide-mouthed, length 200 mm and internal diameter 6·5 mm

Buckets, enamelled, 4 litre capacity

Burette, capacity 50 ml, subdivided into 1/10 ml, with ground glass stopcock

Burette, 25 ml capacity, subdivided into 1/10 ml, with ground glass stopcock

Burette stand, wooden

Burette clamps, metal

Burners: Bunsen, fish-tail, ring, for use with gas

Clay pipe triangle, 7·5 cm

Comparator disc:
  For *p*H, bromothymol blue (6·0-7·6)
  For *p*H, bromo-cresol purple (5·2-6·8)
  For *p*H, methyl red (4·4-6·0)

Comparator for taking *p*H discs

Condenser, glass, double-jacketed, length of jacket 30 cm

Condenser, spiral, glass

Cork borer, set of 12 borers with handle, steel nickel-plated

Cork-borer sharpener

Cork, pressure, wheel pattern

Cork rings, compressed

Cork screw

Crucible, Gooch, porcelain-sintered glass with lid: capacity 30 ml

Crucibles, Gooch, with lid, silica

Cutting plier

Cylinders, measuring, glass, with spout: capacity 2 litres, 1 litre, 500 ml, 250 ml, 100 ml, 50 ml, 25 ml, 10 ml and 5 ml

Cylinders, measuring, glass, with stopper: capacity 50 ml

Cylinders, ungraduated, glass with/without spout: capacity 200 ml and 100 ml

Delivery tubes

Desiccator, glass, with ground glass stopcock on top porcelain/metal disc, internal diameter 20 cm

Diamond-point pencil

Dishes, silica

Dishes with spout, with lids, nickel/aluminium 5 cm in dia and 2·5 cm in height

File, flat, 10 to 15 cm

File, triangular, 10 to 15 cm

Filter pump, glass/metal

Filter stand, wooden, for taking 2 slides

First-aid box with accessories

Flasks, conical, heat-resistant glass: capacity 1 litre, 750 ml, 500 ml, 250 ml and 100 ml

Flasks, flat bottom, heat-resistant glass: capacity 2 litres, 1 litre, 500 ml, 250 ml and 100 ml

Flasks, Kjeldahl, 800 to 1 000 ml

Flasks, measuring, stoppered: capacity 1 litre, 500 ml, 250 ml, 100 ml, 50 ml and 25 ml

Flasks, sugar, measuring: capacity 200 ml and 100 to 110 ml

Forceps, nickel-plated, curved ends, 7·5 cm

Funnel stands, for two

Funnel, vacuum

Funnels, dropping

Funnels, glass, long-stemmed

Funnels, glass, separating, cylindrical: capacity 500 ml and 250 ml

Funnels, glass, without stem: capacity 200 ml, 100 ml and 50 ml

Funnels, glass, with stem: dia 15 cm, 10 cm, 7·5 cm and 5 cm

Gas plant to work on naphtha/petrol: capacity 40 (5·5 m^3/h)/20 (3 m^3/h) burners

Glass beads, 1 to 3 mm dia

Glass cutter

Glass rods, assorted, 2 to 5 mm dia

Glass tubing, assorted, 3 to 10 mm dia

Hammer

Hot-plates, electric, 1 000 W/2 000 W

Hot plates, gas, 1 000 W/2 000 W

Hydrometer, Brix, with a thermometer calibrated at 27·5°C, range 30° to 60° Brix, 20° to 30° Brix, 10° to 20° Brix, 0° to 10° Brix

Hydrometer jars, glass/metal 200 ml

Jars, polyethylene

Jugs, enamel/porcelain

Kjeldahl distillation apparatus, capacity of flask 1 000 ml, complete with condenser, splash head, stand and lamps

Magnet, horse shoe and bar

Maximum-minimum thermometers in °C with magnet

Metre scale

Needle with bent point

Pestle and mortar, porcelain, 20 cm dia

Pestle and mortar, agate, 6 cm dia

Petri dishes, glass, of dia 10 cm

Pinch cocks

Pipette, bulb, one-mark: 100 ml, 50 ml, 25 ml, 20 ml, 10 ml and 5 ml

Pipette, graduated in ml: 10 ml, 5 ml, 1 ml

Pipette case, thick copper cylindrical, with tight-fitting cover, 450 × 70 mm

Pipette stand, wooden

Polariscope

Polariscope standard tubes: 400 mm, 200 mm

Polariscope tube, glass: 400 mm, 200 mm, 100 mm, 50 mm

Polariscope water jacket tubes: 200 mm, 100 mm

Retort stand rings, assorted sizes, 100 to 150 mm

Retort stands

Sample boxes metal/wooden

Sampling can for molasses (*see* IS : 1162-1958*)

Sand-bath

Scissors

Screw drivers

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*Specification for cane molasses.

Sieves set, Indian Standard (2·00 mm to 212 micron) (*see* IS : 460-1962*)

Slides, microscope

Spatula stainless steel/nickel

Stand, tripod, wrought iron

Stand for test-tubes

Steam-bath

Steam generator

Stop-watch, reading to 0·5 second

Stove, primus type

Sugar set, Indian Standard

Test-tubes, with rim, heat-resistant glass: 150 × 25 mm, 150 × 12·5 mm, 125 × 18 mm

Test-tube holders, wooden

Test-tubes, graduated from 5 to 10 ml, glass

Thermometers, graduated in 0°-1°C, 0°-30°C, 0°-50°C, 0°-100°C, 0°-250°C, 0°-360°C

Tiles, white, glazed, porcelain

Timepiece

Tongs, brass, nickel-plated

Trays, plastic/enamel

Tubes, Peligot

Turbidity metre

Wash-bottles, 1 000 ml

Watch-glasses: 150 mm, 125 mm, 100 mm, 75 mm, 62 mm, 50 mm

Water-bath, copper, rectangular, fitted with concentric rings, dia 30 × 20 cm

Water-bath, copper, rocind with concentric rings, dia 30/20 cm, electric, with heat control switches

Water-bath, electric, thermostatically controlled

Weighing bottles, glass

Weights, fractional, 1 to 500 mg

Wire-gauge with asbestos centre, dia of centre 12·5 cm

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*Specification for test sieves (*revised*).

APPENDIX B

(*Clause* 7.1)

LIST OF APPARATUS AND EQUIPMENT REQUIRED FOR SPECIAL ANALYTICAL WORK IN A SUGAR FACTORY LABORATORY

Ball mill with accessories

Calculating machine, hand-operated

Cane crusher, laboratory

Cane shredder, laboratory

Centrifuge

Colony counter, with counting slides

Conductivity bridge with magic eye indication (*see* IS : 1151-1969*)

Dirt correction apparatus, glass

Dirt correction apparatus stand

Discs, brass, circular, dia 25 mm, length 160 mm (*see* IS : 1168-1959†)

Distil water apparatus (electrical)

Distil water still, glass, heat resistant, capacity of flask 2 litres

Filters, spectrum No. 601 and 605 (*see* IS : 1168-1959†)

Hygrometer (wet and dry bulb) with necessary tables for humidity

Imbibition water meters

Kipps apparatus

Klett's colorimeter

Laboratory stirrer, electric

Magnifier (× 2·5), dia 10 cm

Muffle furnace, electric

Nestler tubes

Nutsch apparatus

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*Specification for refined sugar (*first revision*).

†Specification for cube sugar.

Orsat apparatus with accessories

Oven, electric, temperature up to 250°C, with thermometer and two shelves

Oven, vacuum, with accessories

*p*H meter, battery or mains operated with glass, quinhydrone and calomel electrodes

Rain gauge

Refrigerator, electric

Reich & Linge apparatus for sulphur dioxide determination

Salometer (sugar ash bridge)

Sieve, flat, brass, 15 × 14 cm (*see* IS : 1168-1959*)

Sieve shaking machine

Sieves set, Tyler (No. 9 to 65)

Soxhlet extraction apparatus

Spectrophotometer

Steel framework for hardness test for sugar cubes (*see* IS : 1168-1959*)

Trough, glass, dia 30 cm, length 16 cm (*see* IS : 1168-1959*)

APPENDIX C

(*Clause* 8.1)

LIST OF CHEMICALS AND CONSUMABLE STORES REQUIRED FOR ROUTINE ANALYTICAL WORK IN A SUGAR FACTORY LABORATORY

Acetone

Acid, acetic, glacial

Acid, boric

Acid, chromic

Acid, citric

Acid, hydrochloric, fuming, sp gr 1·18

Acid, hydrochloric, sp gr 1·16

Acid, molybdate

Acid, nitric, AR, sp gr 1·42

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*Specification for cube sugar.

Acid, nitric, sp gr 1·42

Acid, oxalic

Acid, phosphoric

Acid, pyrogallic

Acid, salicylic

Acid, sulphuric, sp gr 1·84

Acid, tartaric

Adhesive tape

Alcohol absolute/alcohol ethyl

Aluminium hydroxide

Aluminium sulphate

Ammonia, liquor

Ammonium acetate

Ammonium chloride

Ammonium citrate

Ammonium hydroxide, sp gr 0·88

Ammonium molybdate

Ammonium nitrate

Ammonium oxalate

Ammonium sulphate

Barium chloride

Barium hydroxide

Bark corks, tall form, bottom dia 6 to 50 mm

Bleaching powder

Bromine water

Bromocresol green

Bromophenol blue indicator

Bromothymol blue indicator

Brushes for bottles

Brushes for flasks

Brushes for test-tubes

Calcium chloride

Carbon dioxide gas

Carbon tetrachloride

Charcoal, activated

Chloroform

Copper sulphate

Cotton wool, absorbent, white, sterile

Cresol red

Cupric chloride

Cuprous chloride

Denatured spirit

Dipotassium hydrogen phosphate

Disodium monohydrogen phosphate

Dusters, 60 × 60 cm

Ethylenediamine tetracetic acid (EDTA)

Ether, sulphuric

Ferric citrate

Ferrous chloride

Filter papers, Whatman No. 1 or equivalent quality, assorted sizes/sheets 60 × 45 cm

Filter papers, Whatman No. 44 or equivalent quality, circles

Formaldehyde

Glass marking pencils, assorted colours

Glycerine, sp gr 1·26

Grease for glass stop-cocks

Hydrogen sulphide gas

Iodine, sublimed

Iron wire

Kieselguhr

Labels, preferably gummed back

Lead acetate

Lead nitrate

Lead oxide, red and yellow

Lead subacetate

Lime

Litmus paper strips, blue

Litmus paper strips, red

Luff solution

Magnesium sulphate

Match-boxes

Mercuric chloride paper

Methylene blue indicator

Methyl orange indicator

Methyl red indicator

Murexide indicator

α=nitroso-β-Nephthol

Olive oil, pure

Paraffin wax

Petroleum ether

Phenolphthalein indicator

Phenol red indicator

Potassium bichromate

Potassium carbonate

Potassium chloride

Potassium ferrocyanide
Potassium iodide (iodate-free)
Potassium hydroxide
Potassium oxalate
Potassium permanganate
Potassium phosphate
Potassium sodium tartrate (Rochelle salt)
Potassium thiocyanate
Pumice stone
Rectified spirit
Rubber stopper with 2/3 holes
Rubber tubing, ordinary, assorted sizes
Rubber tubing, pressure, assorted sizes
Sand paper, fine grade
Silver nitrate
Soap solution, standard
Sodium acetate
Sodium carbonate
Sodium carbonate, anhydrous
Sodium chloride
Sodium chloride, AR
Sodium diethyldithiocarbamate
Sodium hydrosulphide
Sodium hydroxide, sticks/pellets
Sodium hydroxide, sticks/pellets, AR
Sodium hydrosulphide
Sodium nitrate
Sodium sulphate, anhydrous
Sodium thiosulphate, AR

Super phosphate

Stannous chloride

Starch soluble, AR

Sucrose, pure

Sulphur

Universal indicator

Uranium acetate

Water, distilled quality

Zinc granules

APPENDIX D

(*Clause* 8.1)

LIST OF CHEMICALS AND CONSUMABLE STORES REQUIRED FOR SPECIAL ANALYTICAL WORK IN A SUGAR FACTORY LABORATORY

Acid, chloroplatinic

Acid, picric

Acid, succinic

Acid, thioglycollic

Agar-agar (bacteriological grade), powder/shreds

Ammonium dihydrogen orthophosphate

Ammonium phosphate

Arsenic trioxide

Beef extract

Benzene

Bromocresol purple (bacteriological grade)

Calcium carbonate

Cobalt nitrate

Conductivity water of specific conductivity not more than 3·0 × 10^{-6} ohms (*see* IS : 1151-1969*)

Cupric sulphate

Dextrin (bacteriological grade)

Diphenylamine

Dithizone

Ferric chloride

Hydrogen peroxide

Hydroquinone

Lead, anhydrous

Malt extract

Magnesium oxide

Mercurous chloride

Peptone (bacteriological grade)

Petroleum jelly, white

Potassium cyanide

Potassium nitrate

Potassium phthlate

Salicylaldoxime

Sodium fluoride

Sodium triphosphate

Toluene

Water, distilled quality, sterile (*see* IS : 1168-1959†)

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*Specification for refined sugar (*first revision*).

†Specification for cube sugar.

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